CITY OF LINCOLN, NEBRASKA, STANDARD SPECIFICATIONS

Chapter 3

PORTLAND CEMENT CONCRETE PAVEMENT

ARTICLE	TITLE
3.11	Alley Pavement & Alley Returns
3.12	Hot & Cold Weather Construction
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CHAPTER 3

PORTLAND CEMENT CONCRETE PAVEMENT

3.00 GENERAL

Portland cement concrete pavement shall be constructed of the materials as herein specified, on an approved subgrade, in accordance with these Specifications and in conformity with the lines, grades, typical cross section, and details shown on the plans.

3.01 RELATED ITEMS SPECIFIED ELSEWHERE

Chapter 1	Pavement Construction & Reconstruction
Chapter 2	Earthwork
Chapter 11	Portland Cement Concrete

3.02 MATERIALS

A. CONCRETE

Unless otherwise specified all Concrete shall be L-3500 as described in Chapter 11 of these Specifications.

B. REINFORCEMENT

All reinforcement bars shown on the plans shall conform to the requirements of "Standard Specifications for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement"ASTM A 615, Grade 40 (300) or grade 60 (420) and shall be free from rust, scale or other substances.

Smooth dowel bars shall be epoxy coated and conform to the requirements of "Structural Steel", ASTM A 36.

Welded steel fabric shall consist of sheets or strips manufactured for the purpose. The fabric shall comply with the "Standard Specifications for Steel Welded Wire Reinforcement Plain for Concrete", ASTM A 185. Intersecting members shall be rigidly welded at right angles in such a manner as to develop the full tensile strength across the weld. Steel fabric is specified on the plans by gauge and spacing of wires. The gauge number specified shall be in accordance with the above reference.

C. REINFORCING BAR SUPPORTS

Reinforcing bar supports for use in concrete pavement shall be of a design and material satisfactory to the Engineer and of sufficient strength to hold the metal reinforcement in place while the concrete is being placed.

3.02 MATERIALS (Continued)

D. METAL DOWEL OR EXPANSION BAR SLEEVE

Metal or plastic sleeves for dowel or expansion bars shall be satisfactory to the Engineer and shall be of sufficient size and strength to permit the free sliding of the dowel bar after the concrete is in place.

E. PREFORMED EXPANSION JOINT MATERIAL

Expansion joint material shall conform to "Standard Specifications for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (non-extruding and resilient bituminous types) ASTM Designation D 1751. The joint material shall be 1 inch thick unless otherwise specified.

F. JOINT SEALER

The joint sealer shall conform to the requirements of "Standard Specification for Joint Sealants, Hot applied, for Concrete and Asphalt Pavements", ASTM Designation D 3405.

G. CURING COMPOUNDS

All curing compounds shall be of the white pigmented liquid membrane-forming type and shall conform to “Standard Specifications for Liquid Membrane -Forming Compounds for Curing Concrete”, ASTM Designation C 309, Type 2, Class A. Only curing compounds included on the latest edition of the NDOR Approved Products list shall be used unless otherwise approved by the Engineer.

All curing compounds shall be ready for use as is without further dilution. The rate of application shall be as recommended by the manufacturer.

H. METAL KEYWAY

Metal keyway, where shown, shall conform to the gauge and cross section shown in the Lincoln Standard Plans.

3.03 PREPARATION OF SUBGRADE

The subgrade shall be prepared as specified in Chapter 2 of these Specifications. To prevent the absorption of moisture from the newly deposited concrete, the subgrade shall be kept moist by light applications of water until the concrete has been placed.

No measurement or direct payment shall be made for preparation of subgrade. The cost of preparation of subgrade shall be considered subsidiary to the other items of work for which direct payment is made.

3.04 FORMS

A. RIGID FORMS

Forms shall be of an approved steel section with a minimum base width of 6 inches and shall have adequate locking devices. The forms shall have a minimum length of 10 feet . On curves having a radius of less than 150 feet, approved wood forms may be used. The depth of forms shall equal at least the depth of the concrete to be placed. No built up forms will be permitted without prior approval of the Engineer.

All forms shall be free from bends and warps at all times. They shall be cleaned thoroughly each time they are used and adequately oiled before concrete is placed against them. The forms shall be set so that they rest firmly throughout their entire length on the thoroughly compacted subgrade. They shall be neatly and tightly joined. They shall be accurately set to line and grade and sufficiently braced to resist the pressure of the concrete. Forms shall be set at least 150 feet ahead of the paving operation.

Sufficient forms shall be provided so that they may remain in place twelve (12) hours or more after the concrete has been placed.

When concrete pavement is being laid contiguous to previously finished pavement of the same finished grade elevation or contiguous to previously finished independent curb or curb and gutter, such finished pavement or curb may be made to serve as side forms.

B. SLIP FORMS

Slip form equipment shall be provided with traveling side forms of suitable dimensions, shapes, and strength to support the concrete for a sufficient length of time during placement to produce the required cross section. The equipment shall spread, consolidate and screed the freshly placed concrete in such a manner as to provide a dense and homogeneous product.

The slip form equipment shall have automatic sensor controls which operate from an offset control line. The line and grade of the slip form equipment shall be automatically controlled.

No direct payment shall be made for forms. The cost of form work shall be considered subsidiary to other items of work for which direct payment is made.

3.05 PLACING REINFORCING STEEL

Reinforcement shall be placed as shown on the plans or Lincoln Standard Plans.

All reinforcing steel shall be kept clean and free from foreign material that will prevent the proper bond with the concrete. Welded wire fabric and welded bar mats shall be furnished in flat sheets and shall be handled carefully during the placing and kept straight until installed.

3.05 PLACING REINFORCING STEEL (Continued)

The reinforcement shall be placed so that the outside longitudinal members will be located no more than 3 inches from the edge of the slab section and the ends of all longitudinal members shall extend to within 2 inches of the ends of the slab sections. Adjacent sheets of welded wire fabric shall be lapped not less than one mesh. The wire fabric shall be tied at all laps. All steel reinforcing bars shall be tied securely in place at all points where the bars cross.

No measurement or direct payment will be made for reinforcing steel. The cost of furnishing and placing reinforcing steel shall be considered subsidiary to other items of work for which direct payment is made.

3.06 CONCRETE PLACEMENT

The concrete shall be deposited uniformly on the prepared subgrades and distributed to the required depth for the entire width of the pavement by shoveling or other approved methods, struck off and finished, as hereinafter provided. Rakes shall not be used in handling concrete.

A. VIBRATING

All concrete shall be thoroughly compacted by means of approved mechanical vibrators. The vibrator shall consolidate the full depth and width of the concrete to a uniform mass without segregation and free from excessive surface mortar at a single passage of the machine. Machine mounted vibrators shall be operated only when the machine to which they are attached is moving. The vibrators shall be placed so as to allow a minimum of overlap vibration.

The concrete shall be well consolidated against the forms. At the end of the day, or in case of an unavoidable interruption of more than thirty (30) minutes, a transverse construction joint shall be placed at the point of the work stoppage. The joints shall conform to the requirements for construction joints as shown on the plans and as specified herein.

No direct measurement or payment shall be made for vibrating or consolidation of the concrete. The cost of vibrating shall be considered subsidiary to other items of work for which direct payment is made.

B. FINISHING

All equipment used for finishing shall meet the approval of the Engineer. Unless otherwise provided in the Special Provisions or approved by the Engineer, hand finishing as described herein may be employed only in cases of emergency and where mechanical methods are impractical.

1. Machine Finishing

The concrete shall be deposited in such a manner that adequate concrete remains ahead of the screed and the finish machine to provide the cross section required. The concrete will then be further consolidated and finished mechanically with a power-driven, self-propelled machine approved by the Engineer. The finish machine shall be operated over the entire width of the pavement section and shall achieve uniform consolidation.

The finishing machine shall be kept in good repair at all times and shall operate so as to give the desired finish over the entire surface of the pavement. The forward speed of the finishing machine shall be adjusted to the average progress of the concrete production, in order that the strike-off operation shall be as continuous and uninterrupted as possible.

The tops of the forms and the contact surfaces of the wheels of the finishing machine shall be kept free from concrete and earth.

Hand tools that perform the function of the finishing machine shall be immediately available for use in the event of an emergency.

After the final pass of the finishing machine, the surface shall be checked and corrected by using approved 10 feet long straight edges and refinished using long handled floats. The use of the long handled floats shall be held to a minimum. The straight edge shall be lapped one-half (½) its length on each successive position.

The Contractor shall furnish and keep in a convenient place a master straight edge, made of 6 inches steel channel, for the purpose of checking all straight edges and the longitudinal float during the progress of the work. A sufficient number of straight edges shall be kept in readiness so as not to delay the paving operations.

In general, the addition of superficial water to the surface of the concrete to assist in finishing operations will not be permitted. However, due to unavoidable delay in finishing or an unusual drying condition, a slight quantity of water may be added to the surface of the concrete as an aid in finishing. If it becomes necessary to sprinkle the surface with water to complete the finishing of the concrete, all mixing operations shall be immediately discontinued until the finishers catch up to a point where extra water for finishing is no longer required. If the application of water to the surface is permitted, it shall be applied in a fog spray by means of an approved orchard-type sprayer. Spray equipment which is attached to the mechanical finisher, or any other paving equipment, will not be permitted. The addition of superficial water to the surface of the concrete shall be at the Contractor's risk. The pavement shall be given a finish by means of a wet burlap drag. The drag shall be pulled in a longitudinal direction only. The drag shall be adequately maintained so that the resultant finish shall be uniform in appearance.

2. Hand Finishing

After the concrete has been placed and spread, it shall be thoroughly consolidated by the use of approved vibrating screeds and struck off to a uniform height above the finished grade to the true cross section. When a non-vibrating hand screed is used or the pavement design thickness is greater than 6 inches, the concrete shall be consolidated with an approved mechanical vibrator before the concrete is struck off.

The screed used shall be of a design and construction suitable and adequate for the purposes required. It shall be designed to ride on the side forms of the pavement. The screed shall be of metal or steel-shod wood and shall have sufficient strength and stiffness to retain its shape under all working conditions. The working or screeding edge shall be shaped to match the required cross section of the pavement. The screed shall be operated so that when riding on the side forms, the working edge will have an excess of concrete above grade to produce the required cross section after consolidation.

After the concrete has been consolidated and struck off, the surface shall be finished as specified above under machine finishing.

3. General Finishing

Prior to the time the concrete takes its initial set, all expansion and construction joints and exposed edges shall be carefully finished with an edger having a radius of not less than 1/4 inch. The edge shall be left smooth and true to line and grade. The Contractor shall provide a suitable work bridge spanning the concrete placement to facilitate the edging.

Upon removal of the forms, all honeycombed areas or small defects shall be properly pointed up with 1:2 mix grout and the concrete previously protected by the forms shall be cured as hereinafter specified or as directed by the Engineer.

4. Surface Tests

After the pavement has been set sufficiently to permit foot traffic, the slab will be thoroughly checked by the Engineer or observer. All variations in excess of 1/8 inch, measured from the surface of the concrete in place with a 10 foot straight edge or other device used for measuring deviations from a plane, shall be plainly marked. The Contractor shall eliminate such variations. When the surface finish of the pavement has been disturbed by grinding, the surface shall be repaired with the use of an approved sealant. The use of mechanical grinders will be permitted if their use does not, in the opinion of the Engineer, damage the pavement.

Finishing the concrete pavement shall not be measured and paid for directly. The cost of the finishing will be considered subsidiary to the cost of other work for which direct payment is made.

3.07 JOINTS

A. TRANSVERSE CONSTRUCTION JOINTS

Whenever concrete pavement construction is stopped for a period of over 30 minutes, a transverse construction joint shall be formed by finishing the concrete to a bulkhead made of at least 2 inch material cut to the exact cross section of the pavement slab, as shown on the plans. The bulkhead shall be placed on the subgrade perpendicular to the pavement surface and at right angles to the center line of the roadway. An edging tool shall be used along the bulkhead to make the construction joint a well-defined line. Construction joints shall not be spaced closer than 10 feet . When the placing of concrete is resumed, the bulkhead shall be removed and care shall be taken not to disturb any steel or concrete placed. The new concrete shall be placed directly against the face of the concrete previously placed. The joint shall be formed and finished so the surfaces of the previously placed concrete and new concrete correspond exactly to the cross section and grade shown on the plans.

B. EXPANSION JOINTS

1. Transverse

When transverse expansion joints are indicated on the plans, they shall be constructed at the location and in accordance with details shown in the plans or Lincoln Standard Plans. The joint material shall extend entirely through the pavement and shall be placed so the top edge will be 3/8 inch below the surface of the finished pavement and curb.

During the placing and the finishing of the concrete pavement, the expansion joint material shall be held securely by means of a special holder approved by the Engineer. Extreme care shall be exercised in placing concrete around the joint so the joint will remain in the true position specified herein.

After the edges have been rounded, the surface of the pavement across the joint shall be tested with a 10 foot straight edge placed parallel to the center line of the pavement and drawn from the center of the pavement to the edge. Any high spots or depressions shall be eliminated and the edges rounded as hereinbefore specified. Any surplus concrete at the ends of the joints shall be cut away when the forms are removed.

2. Other

Expansion material shall be formed around all objects that project through the pavement unless otherwise directed. When the pavement is placed against buildings, sidewalks and other unyielding objects, 1 inch expansion joint material shall be placed between the object and the new concrete.

C. CONTRACTION JOINTS OR PLANES OF WEAKNESS

Contraction joints or planes of weakness called for on the plans shall be constructed at the locations indicated and in accordance with details shown on the plans or as directed by the Engineer. Maximum joint spacing shall be 15 feet unless otherwise directed by the Engineer.

3.07 JOINTS (Continued)

C. CONTRACTION JOINTS OR PLANES OF WEAKNESS (Continued)

All joints shall be made with a motor driven concrete saw to a minimum depth of one-fourth (1/4) the pavement thickness. The sawing shall be accomplished not later than forty-eight (48) hours after concrete placement nor so soon as to cause spalling of top aggregates. When "extra strength" concrete is used, the joints shall be sawed within twenty-four (24) hours after concrete placement. Transverse contraction joints generally shall be sawed within eighteen (18) hours after concrete placement. In any event, the concrete shall be sawed before random cracks develop. The sawing of any joint shall be discontinued if a crack occurs at or near the joint location prior to the time of sawing. Sawing shall be discontinued when a crack develops ahead of the saw.

Cracks developing before sawing commences or cracks developing ahead of the saw shall be routed to a depth of 3/8 inch by 3/8 inch in width. The joint between the curb and gutter section and concrete pavement shall be sawed to a depth of 1 inch and sealed.

D. JOINT SEALING

All expansion and saws joints shall be sealed as provided herein.

As soon as the joints are sawed and before traffic is allowed on the pavement, the joint shall be thoroughly cleaned by abrasive blasting or other approved means to remove all mortar, laitence, scale, dirt, dust, oil, curing compounds and other foreign material.

The joint shall be blown out with high pressure compressed air to remove all residue.

The joint shall be filled from the bottom to the top without formation of voids. The top of the finished joint seal shall be between 1/4 inch and 3/8 inch below the finished surface, unless shown otherwise on the plans.

At the time of application of the joint sealant, the joint and pavement shall be dry and acceptable to the Engineer. No sealant shall be placed during unsuitable weather or when the atmospheric temperature is below 50°F or when weather conditions indicate that the temperature may fall below 32°F within twenty-four (24) hours.

The joint sealing filler shall be melted uniformly and with constant stirring in an asphalt kettle of the double boiler design with oil being used as the heating medium. The material shall be furnished or prepared in pieces of such size and shape that the material can be melted readily to the proper pouring consistency. The Contractor shall obtain from the supplier or from the manufacturer and furnish to the Engineer the manufacturer's recommendations for mixing, application and temperature restrictions. These recommendations shall be followed strictly. In no case shall the temperature exceed the maximum recommended by the manufacturer. When proper pouring consistency is attained, the joints shall be filled as shown in the plans, through the use of pressure-type applicator, of a design approved by the Engineer and equipped with a nozzle which will fit into the joints.

All adjoining surfaces shall be carefully protected during the joint sealing operations, and any stains, marks or damage thereto, as a result of the Contractor's operations, shall be corrected in a manner satisfactory to the Engineer.

No direct measurement or payment will be made for joints or joint sealant. The cost of jointing and joint sealing shall be considered subsidiary to other items of work for which direct payment is made.

3.08 CURING AND PROTECTION

A. CURING

1. Curing With Liquid Membrane Curing Compound

Immediately after the concrete has been finished, the concrete surface and exposed vertical edges shall be sealed with a uniform application of a membrane curing compound as described previously in this chapter. An approved self propelled mechanical power sprayer shall be used to apply the curing compound to the concrete pavement except that approved manual spraying equipment may be employed on narrow or variable width sections where the use of a self-propelled mechanical power sprayer is impractical, and on irregular sections of street returns and alley returns.

2. Curing With Wet Burlap

Immediately after the concrete has been finished, burlap shall be carefully placed on the concrete and kept moist in a manner which will not damage the pavement surface. The burlap shall be clean, evenly woven, free of encrusted concrete or other contaminating materials, and shall be reasonably free from cuts, tears, broken or missing yarns, and thin, open or weak places.

The burlap shall be of sufficient length to cover all exposed surfaces including the vertical edges of the slab. At exposed vertical edges of the slab, earth shall be banked so that the top width of the berm shall be at least 6 inches.

The burlap shall be kept continuously saturated with water for at least 72 hours following the placing of the concrete, except that the burlap may be temporarily removed so that joints may be sawed and filled, the surface tested, and any grinding or rubbing necessary may be accomplished. While the pavement is uncovered, it shall be kept wet by sprinkling with water. Concreting operations shall be suspended when water is not available to cure the concrete.

B. PROTECTION

The Contractor shall provide and maintain substantial barricades, warning signs, flares and, when required, watchmen to protect the new pavement and work site from vandalism and property destruction.

B. PROTECTION (Continued)

Any concrete showing injury from vandalism shall be repaired or removed and replaced at the Contractor's expense, to the Engineer's satisfaction. No heavy equipment or vehicular traffic shall be allowed on the new construction until the concrete has achieved a compressive strength of 3,000 p.s.i. or seven (7) days have elapsed. A longer period of time may be required if, in the opinion of the Engineer, the concrete is not of sufficient strength to support the equipment or vehicles.

No direct measurement or payment shall be made for curing and protection. The cost of curing and protection shall be considered subsidiary to other items of work for which direct payment is made.

3.09 BASIS OF PAYMENT

Reinforced concrete pavement of the various thicknesses called for in the proposal, constructed in conformance with these Specifications and accepted by the Engineer, shall be measured and paid for at the contract unit price bid per square yard for ___ INCH REINFORCED PORTLAND CEMENT CONCRETE PAVEMENT. Such payment shall be full compensation for all subgrade preparation, form work, reinforcing steel, placing concrete, vibrating, finishing, jointing, sealing, curing, protection, headers, integral curbs if required, materials, equipment, tools, labor and incidentals necessary to complete the work.

Plain (non-reinforced) concrete pavement of the various thicknesses called for in the proposal, constructed in conformance with these Specifications and accepted by the Engineer, shall be measured and paid for at the contract unit price bid per square yard for ___ INCH PORTLAND CEMENT CONCRETE PAVEMENT. Such payment shall be full compensation for all subgrade preparation, form work, placing concrete, vibrating, finishing, jointing, sealing, curing, protection, headers, integral curbs if required, materials, equipment, tools, labor and incidentals necessary to complete the work.

3.10 INTEGRAL CURB

When required, integral curb shall be constructed on the edge of the concrete slab in conformance with the plans and typical cross section. The concrete for the integral curb shall be of the same mixture as used in the concrete slab.

The finish machine screed template should preferably leave enough concrete at the curb location to eliminate further carry-back and handling of the concrete. The steel curb template shall be an integral part of the finish machine with a self-contained vibrator for the curb section.

When authorized by the Engineer, the curb may be placed immediately after the concrete in the pavement has been placed and finished, but before the concrete develops its initial set, by means of a curb machine equipped with a steel template and self-contained vibrator. Hand placement methods shall be finished with the aid of a metal mule template. This method shall be used only where specifically authorized by the Engineer.

No direct measurement or payment shall be made for integral curb. The cost of integral curb shall be considered subsidiary to the items for which direct payment is made.

3.11 ALLEY PAVEMENT AND ALLEY RETURNS

The finishing of concrete alley pavement and concrete alley returns shall proceed, in general, in accordance with the methods specified above under "Hand Finishing", with the modification that after the required strike off and consolidation, the surface shall be floated longitudinally with a wooden float.

Where walls of buildings or other obstructions exist immediately adjacent to alley lines and against which the new pavement must be placed, necessary modifications of the methods specified in this section will be approved by the Engineer. No essential requirements, however, relating to quality of workmanship or trueness to grade and cross sections shall be waived. In general, a temporary screed strip shall be set to the proper grade, parallel to the alley line and approximately 1 foot therefrom, and a somewhat shorter screed shall be used. As soon as the necessary screeding has been completed, the screed strip shall be immediately removed and the space filled with fresh concrete. Final finishing shall then be completed as specified under machine finish of these specifications. All jointing, jointing patterns, and typical sections shall conform to Lincoln Standard Plans.

BASIS OF PAYMENT

Alley pavement of the various thicknesses called for in the proposals, constructed in conformance with these Specifications and accepted by the Engineer, shall be measured and paid for at the contract unit price bid per square yard for ___ INCH PORTLAND CEMENT CONCRETE ALLEY PAVEMENT. Such payment shall be full compensation for all subgrade preparation, form work, reinforcing steel if required, placing concrete, vibrating, finishing, jointing, sealing, curing, protection, materials, equipment, tools, labor and incidentals necessary to complete the work.

3.12 HOT AND COLD WEATHER CONSTRUCTION

Portland cement concrete paving work shall be accomplished only as provided in Section 1.06 of these Specifications.

3.13 SUBSTANTIAL COMPLETION

Paving construction will be considered substantially complete when it meets all of the requirements of Section 1.07 of these Specifications.